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Smart Beta: Managing Diversification of Minimum Variance Portfolios

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Discussion – Marie Brière

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The paper in brief

- Paper proposes a unified framework to understand risk-based portfolios
  - Global minimum variance (GMV)
  - Equal weight (EW)
  - Equal risk contribution (ERC)
  - Max diversification portfolio (MDP)

- These portfolios are special cases of a volatility minimization problem with different diversification constraints
  - GMV: only budget constraint
  - EW: add Herfindahl index « weight diversification » constraint $\sum_{i=1}^{n} x_i^2 \leq c_1$
  - ERC: add « risk contribution diversification » constraint $\sum_{i=1}^{n} \ln x_i \geq c_2$
  - MDP: « diversification ratio » constraint $\sum_{i=1}^{n} x_i \sigma_i \geq c_3$

- Constraints can be relaxed by changing the values of c1, c2 and c3

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The paper in brief

- Characterizes the tradeoff between (1) portfolio volatility, (2) the 3 different forms of “diversification”, (3) deviation to the cap weighted index (TE or beta)
  - Each « smart beta » strategy targets a different level of volatility reduction
  - When adjusting the constraint to target the same level of volatility, the portfolios become comparable

- Proposes a unified optimization framework allowing to mix the diversification constraints
  - Two parameters to control the tradeoff between the different forms of diversification
  - A third parameter to control for TE

- Examines the out of sample performances of smart beta portfolios during bull and bear markets and proposes dynamic smart beta rebalancing strategies depending on market conditions
  - Bull market : high diversification
  - Bear markets: high volatility reduction

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General comments

- Very nice, clearly written paper

- Tackles a very interesting question, important for practitioners: the tradeoff between mean-variance efficiency and “diversification”
  - Portfolios constructed using sample moments often involve very extreme positions, practitionners do not like it !

- Provides very useful results

Background

- What is the relationship between “weight diversification” and mean-variance efficiency ?
  - Mean-variance efficient portfolios are not necessarily well diversified
  - Mean variance CAPM requires diversification only if the market cap weighted ptf is diversified
  - Black and Litterman (1990) : extreme weights generated by asset allocation models are a major **obstacle to implementation**
  - Practitionners suspicious of ptf not naively diversified: very often implement weight constraints to force diversification (success of 1/N ptf, etc.)

- All this justifies the interest of introducing a diversification constraint in ptf optimization techniques, but what is precisely the objective?

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Questions

- Q1: Why a diversification constraint?
  - Hypothesis 1: **Reduce the estimation error**
  - The **investor cares only about volatility reduction** – diversification constraints are here only to help achieving **efficient volatility reduction out of sample**

- Csq: the portfolios should be evaluated **out of sample** on their volatility reduction **compared to the GMV** (and not the market cap portfolio)
  - If extreme weights are due to estimation errors in the sample moments, then adding diversification constraints should help
  - If extreme weights are due to the characterisics of the asset returns' moments, then diversification constraints will not add much
  - It would be interesting to know !

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Questions

- Q1: Why diversification constraints?
  - Hypothesis 2: **This is part of the investor's objectives**
  - Having low diversification is a problem per se for the investor and should enter the objective function of the investor
- Csq: the portfolio should be evaluated in sample but **also out of sample** on the corresponding diversification measures as well
  - This is lacking in the paper: we only have a comparison of volatility reduction / TE (fig 2.10 & 2.11)
  - Add the risk diversification / diversification ratio out of sample measures

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Questions

- Q2: Evaluation of the smart beta strategies

- Is volatility the best measure to consider to assess the portfolio risk?
  - We know that naive diversification strategies like 1/N **increase tail risk** and make ptf returns more concave relative to MC ptf because it is similar to a conservative long term asset mix (buy equities as equity market falls and sell them when it rises).
  - **Manipulation-proof performance measures** (Goetzmann et al., 2007) ?

- Other criterias to evaluate the portfolios?
  - Table 2.5 shows that when adjusting the diversification constraints to achieve the same level of volatility reduction, the 3 diversification constraints become comparable, returns are highly correlated across diversification strateiges
  - Other criteria needed to assess the ptf ?
  - **Distance to the efficient frontier?** Horizontal or vertical distance (Basak et al., 2002 ; Brière et al., 2013), **Turnover of the portfolios** ?

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Questions

- Q3: Could we try to characterize the tradeoff between volatility reduction and diversification?
  - Green and Hollified (JoF 1992) show that extreme weights in minimum variance portfolios are due to the **dominance of a single factor in the covariance structure of returns**, this creates high correlation between naively diversified portfolios
  - Csq: If one single factor dominates, using a diversification constraint might not be a good idea
  - We will loose a lot in terms of volatility by forcing a certain level of diversification
- Could be interesting to examine the dispersion of individual assets beta in the different universe as an factor explaining the tradeoff between volatility reduction and diversification
  - For ex: Emerging markets: strong beta dispersion, less concentrated portfolios (there is more « natural » diversification), the diversification constraint should penelize less than for a small universe (Eurostoxx 50) much more concentrated

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Questions

- Q3 (ctnd): Could we try to characterize the tradeoff between volatility reduction and diversification?

  – Seems to be true from Fig 2.11: when imposing same equal weight constraint to all indices, volatility increase depends on the universe

  – Related to the beta dispersion

	Average volatility reduction		volatility increase	beta dispersion
	GMV	EW	from GMV to EW	
SX5E	38	0	38	0.12
TPX100	45	3	42	0.15
SPX	50	-10	60	0.23
MXEF	70	5	65	??

  – This tradeoff might be different for alternative « diversification constraints », also involving the volatilities

Questions

- Q4: Next step ? Mean variance framework with a diversification constraint ? Introducing expected returns ?

- Alternative way to present the results?
  - present the optimisation problem as a multi-criteria optimisation problem like portfolio optimization with skewness, kurtosis etc.
  - Different levels of risk aversion to the different diversification measures (see Jondeau and Rockinger EFM 2006 for ex)
  - Build a 3-dimensions efficient frontier (risk, return, diversification) allowing to represent the tradeoff between risk/return and diversification

Minor Comments

- C1: Why does the « max diversification » constraint appear in the budget constraint and not in the diversification constraint ?
  – We could have a diversification constraint with 2 parameters representing the tradeoff between the 3 types of diversification constraints

$$D(x;\gamma) = \gamma \sum_{i=1}^{n} \ln x_i - (1-\gamma) \sum_{i=1}^{n} x_i^2$$

$$\mathcal{B}(x;\delta) = \delta \sum_{i=1}^{n} x_i + (1-\delta) \sum_{i=1}^{n} x_i \sigma_i$$

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